

FRAGMENTATION OF COMET SHOEMAKER-LEVY 9'S NUCLEI DURING FLIGHT THROUGH THE JOVIAN ATMOSPHERE

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Evidence on meteors and bolides shows that their fragmentation- both in discrete events and continuous- is a major ablation process for all impactors penetrating the Earth's atmosphere and of paramount importance, vastly surpassing evaporation and fusion, for impactors of the "soft", cometary type. The susceptibility to fragmentation appears to be independent of the impactor's mass. Models accounting for fragmentation indicate that the nuclei of Comet Shoemaker-Levy 9, whose sizes upon entry into the Jovian atmosphere were a few kilometers, disintegrated almost completely by the time they reached pressure levels of a little less than 1 bar. The residual masses of these impactors involved in terminal explosions and responsible for upswelling plumes of particulate debris, detected with the Hubble Space Telescope, are found to have represented not more than ~ 1 percent of their preatmospheric masses. This result, which is consistent with impact scenarios based on observed precursor-event timings, implies that the entry mass of the comet's largest fragments was $10^{15.5}$ to 10^{16} g apiece and that the mass of the comet's original nucleus must have been near 10^{17} g.